PATENT ABSTRACTS OF JAPAN

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(71)Applicant : NISSAN MOTOR CO LTD

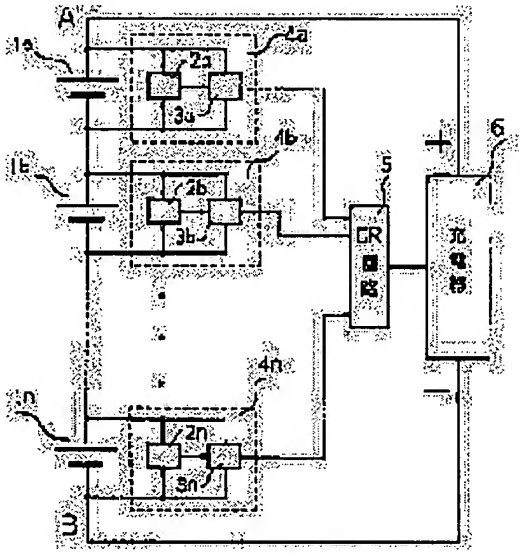
(72)Inventor : MORITA KOJI

(54) CHARGER FOR BATTERY SET

(57)Abstract:

PURPOSE: To charge a battery set with a large current by suppressing bypass capacitance.

CONSTITUTION: A charger 6 is connected to a battery set where a plurality of single batteries 1a-1n are connected in series, and also constant voltage circuits 4a-4n consisting of constant voltage controllers 2a-2n and current saturation detectors 3a-3n are connected, respectively, in parallel to each single battery 1a-1n. The constant voltage controllers 2a-2n controls the terminal voltage constant by detecting the voltage of terminals, and comparing the detection value with the set voltage, and bypassing the charge current, according to the error upon comparison. And, the current saturation detectors 3a-3n output command signals to a charger 6 through an OR circuit when the bypass currents are saturated, and the charger 6 reduces the charging current, receiving the command signal. Hereby, the capacity of the bypass current can be set small, and also the charging with a large current is possible.



LEGAL STATUS

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CLAIMS

[Claim(s)]
[Claim 1] Charging equipment of a group cell characterized by providing the following. It is the charging equipment of a group cell by which two or more cells were connected to a serial, respectively, said group cell is charged, and it is the controllable charge means of the charging current. A voltage detection means to detect terminal voltage of each of said cell A constant-voltage means to control terminal voltage of a cell by being installed in said each cell and making the charging current of a cell bypass A current saturation detection means to detect that said bypass current was saturated, and a control means which controls said charge means to decrease the charging current based on an output of said current saturation detection means
[Claim 2] Charging equipment of a group cell characterized by providing the following. It is the charging equipment of a group cell by which two or more cells were connected to a serial, respectively, said group cell is charged, and it is the controllable charge means of the charging current. A voltage detection means to detect terminal voltage of each of said cell A constant-voltage means to control terminal voltage of a cell by being installed in said each cell and making the charging current of a cell bypass A control means which controls said charge means to decrease the charging current based on an output of a logical circuit which will output a saturated signal if it has a current saturation detection means to detect that said bypass current was saturated and at least one piece outputs according to an output of said current saturation detection means, and a logical circuit
[Claim 3] Charging equipment of a group cell characterized by providing the following. It is the charging equipment of a group cell by which two or more cells were connected to a serial, respectively, said group cell is charged, and it is the controllable charge means of the charging current. A voltage detection means to detect terminal voltage of each of said cell A constant-voltage means to control terminal voltage of a cell by being installed in said each cell and making the charging current of a cell bypass A control means which controls said charge means to decrease the charging current based on an output of a logical circuit which will output a saturated signal if it has a current saturation detection means to detect that said bypass current was saturated, said two or more cells are divided into an unit block of a predetermined number and said at least one current saturation detection means outputs in each unit block, and a logical circuit
[Claim 4] Said constant-voltage means is the charging equipment of a group cell according to claim 1, 2, or 3 characterized by receiving current supply from a cell with which it was installed.
[Claim 5] It is the charging equipment of a group cell according to claim 1, 2, 3, or 4 which said charge means performs constant-current charge, and is characterized by a control means of said charge means controlling said charge means to decrease the charging current of said charge means gradually based on an output of said current saturation detection means, or an output of a logical circuit.
[Claim 6] A decrement for every phase of said charging current is the charging equipment of a group cell according to claim 5 which is more than the bypass current capacity of said constant-voltage means, and is characterized by considering as 2 double less or equal.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the charging equipment of the group cell which connected two or more cells to the direct example.
[0002]
[Description of the Prior Art] As charging equipment of the conventional group cell, there are some which are indicated by JP,61-206179,A, for example. In case the zener diode for equating charge to each cell which constitutes a group cell is connected to juxtaposition in the direction of reverse bias current and this charges a group cell, it is the configuration of bypassing the charging current and adjusting advance of charge by breakdown of zener diode according to the rise of the terminal voltage of each cell.
[0003]
[Problem(s) to be Solved by the Invention] However, if it is in such a conventional thing, it is a thing using breakdown of zener diode, and it is necessary to select zener voltage according to the charge termination voltage of a cell beforehand. And in order to prevent a surcharge, it is necessary to bypass so that the charging current from a battery charger may not be completely passed to a cell. For this reason, when the charging currents, such as a case of boosting charge or a mass cell, were large, it must be the mass thing to which bypass circuits, such as zener diode, **** in it, and, as a result, there was a problem of the cure against stripping etc. and cost rise of heat by bypass current. Furthermore, since this mass zener diode needs to be arranged at each cell, it also has the problem of taking a large space. Therefore, in view of the above conventional troubles, this invention stops the current capacity of a bypass circuit, and aims at moreover offering the charging equipment of the group cell in which high current charge is possible.
[0004]
[Means for Solving the Problem] Invention according to claim 1 is the charging equipment of a group cell by which two or more cells were connected to a serial, respectively, and said group cell is charged. For this reason, a controllable charge means of the charging current, A voltage detection means to detect terminal voltage of each of said cell, and a constant-voltage means to control terminal voltage of a cell by being installed in said each cell and making the charging current of a cell bypass, It shall have a current saturation detection means to detect that said bypass current was saturated, and a control means which controls said charge means to decrease the charging current based on an output of said current saturation detection means.
[0005] Invention according to claim 2 is the charging equipment of a group cell by which two or more cells were connected to a serial, respectively, and said group cell is charged. A controllable charge means of the charging current, A voltage detection means to detect terminal voltage of each of said cell, and a constant-voltage means to control terminal voltage of a cell by being installed in said each cell and making the charging current of a cell bypass, A logical circuit which will output a saturated signal if it has a current saturation detection means to detect that said bypass current was saturated and at least one piece outputs according to an output of said current saturation detection means, It shall have a control means which controls said charge means to decrease the charging current based on an output of a logical circuit.
[0006] Invention according to claim 3 is the charging equipment of a group cell by which two or more cells were connected to a serial, respectively, and said group cell is charged. A controllable charge means of the charging current, A voltage detection means to detect terminal voltage of each of said cell, and a constant-voltage means to control terminal voltage of a cell by being installed in said each cell and making the charging current of a cell bypass, It has a current saturation detection means to detect that said bypass current was saturated. A logical circuit which will output a saturated signal if said two or more cells are divided into an unit block of a predetermined number and said at least one

current saturation detection means outputs in each unit block, It shall have a control means which controls said charge means to decrease the charging current based on an output of a logical circuit.

[0007]

[Function] In invention according to claim 1, the constant-voltage means connected to each cell by bypassing the charging current of a cell based on the terminal voltage Control terminal voltage to a constant voltage and a current saturation detection means supervises actuation of a constant-voltage means. When bypass current is saturated, a saturated signal is outputted, and since a control means controls a charge means to decrease the charging current according to a saturated signal, even if a capacity setup of bypass current is smaller than the charging current, a constant-voltage means is always in a controllable condition, and controls terminal voltage. This can constitute a constant-voltage means from an element with small current capacity. If logical operation is carried out to the output of each current saturation detection means and the voltage stabilizer of a piece is saturated at least, since a logical circuit will output a saturated signal to a control means and will operate a control means, it can control the terminal voltage of each cell by invention according to claim 2 to homogeneity.

[0008] In invention according to claim 3, if logical operation is carried out to the blocked cell and at least one voltage stabilizer is saturated in each unit block, since a logical circuit will output a saturated signal to a control means and will operate a control means, it can prevent that the charging current of the whole group cell by the rise of the terminal voltage of one cell with which balance collapsed is extracted.

[0009] And the current supply of each constant-voltage means can unify a cell and a voltage stabilizer, when carried out from the cell installed, respectively. And a charge means performs constant-current charge, and if a control means is controlled to decrease the charging current of said charge means gradually, it can shorten the charging time until it becomes a full charge. And the decrement for every phase of the charging current is more than the bypass current capacity of said constant-voltage means, and it can prevent the increment in the charging time while a constant-voltage means does not always need to operate and ****** can perform pyrexia by bypass current even in **, if set up with 2 double less or equal.

[0010]

[Example] Drawing 1 shows the 1st example of this invention. A configuration is explained first. While it connects with a serial and two or more cells 1a, 1b, --, 1n constitute a group cell, voltage stabilizers 4a and 4b and --4n are connected to each cell at juxtaposition. An each voltage stabilizers [4a, 4b, --, 4n] output is connected with a battery charger 6 through OR circuit 5. The output terminal of a battery charger 6 is connected to A of a group cell, and a battery terminal. A voltage stabilizer 4 (4a, 4b, --, 4n) like drawing 1 The terminal voltage control section 2 (2a, 2b, --, 2n), It consists of current saturation detecting elements 3 (3a, 3b, --, 3n), and the terminal voltage control section 2 is controlled to keep terminal voltage constant by detecting the voltage of a cell 1 and making the charging current bypass according to the error which compared the detection value as compared with the built-in programmed voltage. The current saturation detecting element 3 judges that the bypass current which detects the terminal voltage of a cell and flows from the detection value to the terminal voltage control section 2 was saturated, and outputs the command signal which decreases the charging current to a group cell. And this command signal is logic-ized by OR circuit 5, and is outputted to a battery charger 6.

[0011] A battery charger 6 consists of reference voltage generators 62, 63, and 64 for connecting with the positive terminal of amplifier 61 in response to the signal from OR circuit 5 through contacts S1, S2, and S3, the control section 67 which controls actuation of S4, the amplifier 61 which constitutes a constant-voltage-constant current generator, NPN transistor 65 and resistance 66, and said contacts S2 and S3 and S4, and generating a constant voltage, as shown in drawing 2 .

[0012] A fixed difference is prepared in each voltage in cells 62, 63, and 64, and the difference is set up the twice of the minimum voltage. For example, by 6V, when a cell 64 is 2V, a cell 63 is set up so that a cell 62 may be 10V. The charging current is determined by the ratio of the voltage value of the cell connected to the positive terminal of amplifier 61, and the resistance of the shunt resistance 66. For example, in this example, since the charging current needs 25A, if the above-mentioned voltage value is used, the shunt resistance 66 will be set as 0.4 ohms. Therefore, 15A and 5A besides a maximum of 25A can be generated by the change of contacts S2 and S3 and S4 in this case.

[0013] When charging, contacts S1 and S2 are closed first, and while the charging current of 25A occurs, it is outputted to a group cell from A and a battery terminal. A counter will operate and a control section 67 will count the count of an input of a command signal, if it has a counter and a timer inside and a command signal is inputted from OR circuit 5. The contact made to have corresponded beforehand closes according to the number of counts.

[0014] the time of the number of counts being 0 in this example -- S -- the time of 2 and 1 -- S -- it is made to have corresponded at the time of 3 and 2, so that S4 may be closed Therefore, according to the increment in the number of

command signal inputs, the charging current decreases gradually from 25A to 15A and 5A. And if a timer operates and the setup time passes at the same time contact S4 closes, a contact S1 will be opened and the charge to a group cell will be ended.

[0015] Drawing 3 shows the configuration of the terminal voltage control section 2 which constitutes a voltage stabilizer 4, and the current saturation detecting element 3. Zener diode 42 and resistance 41 generate reference voltage, and input reference voltage into the inversed input terminal of amplifier 47 and 50 through the input-protection resistance 46 and 48. Variable resistance 43 is resistance which pressures the terminal voltage of a cell 1 partially, and constitutes the circuit which inputs into the non-inversed input terminal of amplifier 47 through the input-protection resistance 45, and detects the potential difference between the terminal voltage of a cell, and a programmed voltage. NPN transistor 53 by which the base is connected to the output terminal of amplifier 47 controls the collector current which flows resistance 52 according to the voltage impressed between the base and an emitter. The input-protection resistance 49 connected to a comparator 50 and its non-inversed input terminal and the variable resistance 44 which pressures terminal voltage partially constitute the current saturation detector which reverses output polarity with a terminal voltage value. The detecting signal is outputted to OR circuit 5 by the photo coupler 55 connected to the output terminal of a comparator 50. Resistance 54 is for restricting the operating current of a photo coupler 55.

[0016] While charging a group cell, the terminal voltage of each cell rises according to progress of the charging time. While the terminal voltage of a cell 1 does not reach a programmed voltage, the output voltage of amplifier 47 serves as negative, and, in NPN form TORAJISUTA 53, the charging current does not flow for resistance 52 by the cut off state. If the terminal voltage of a cell 1 reaches a programmed voltage, the output of amplifier 47 serves as positive, NPN transistor 53 flows through it, a part of charging current will be bypassed by resistance 52, and it will flow to it. In this case, since the voltage impressed between the base and an emitter is large if terminal voltage is large, the current which flows resistance 52 is also large. Finally the terminal voltage of a cell 1 is kept constant.

[0017] When time amount furthermore passes, NPN transistor 53 goes into a current saturation field gradually, and it becomes impossible to control the terminal voltage of a cell. If it does so, the terminal voltage of a cell 1 will begin to rise again. If terminal voltage rises to the turn-over-voltage value of a comparator 50, a comparator 50 will be reversed, a photo coupler 55 will energize, and the command signal for decreasing the charging current will be outputted to an OR circuit. In response to this signal, battery chargers 6 decrease in number the charging current. By this, the voltage drop by the internal resistance of a cell 1 decreases, the voltage between terminals is less than a programmed voltage, and a transistor 53 returns to a cut off state at a condition with controllable return and voltage stabilizer 4.

[0018] Drawing 4 is a flow chart which shows the control action in the above-mentioned configuration. Drawing 5 shows change of the charging current which flows to the cell when constituting a group cell from 144 cells of capacity 50Ah. Drawing 6 shows change of the terminal voltage of the cell. In case it charges, timer time amount is set up first. If charge is started, at step 100, a control section 67 will output a reset signal, will clear a counter, and will set the number of counts to 0. A contact S1 is closed and it changes into the condition that the charging current can be outputted. In step 101, according to the number of counts, a contact S2 is set as closing, the charging current is set as 25A, and it is outputted. At step 102, it is confirmed whether the charging current is 5A of a culmination. When it is not 5A, it progresses to step 103.

[0019] At step 103, each voltage stabilizer 4 detects the terminal voltage of a cell 1. Step 104 compares the detected terminal voltage with a programmed voltage. As a result of a comparison, while terminal voltage like a' line of drawing 6 is smaller than a programmed voltage, step 104 is repeated, and a new comparison is sometimes performed with the terminal voltage of ****. The current which flows to a cell 1 at this time is the same 25A as the charging current like a line of drawing 5 . Progressing to step 105, if terminal voltage becomes larger than a programmed voltage, a voltage stabilizer 4 controls bypass current based on the voltage difference of terminal voltage and a programmed voltage, and performs constant-voltage control. Like b line of drawing 5 , with progress of charge, the charging current is bypassed and the current which flows to a cell 1 at this time decreases. The portion of hatching shows quantity of electricity of bypassed 0.14Ah(s). The terminal voltage at that time is kept constant as shown by b' line of drawing 6 .

[0020] In step 106, a voltage stabilizer 4 judges whether bypass current was saturated from terminal voltage, while bypass current is not saturated, step 106 is repeated, and new decision is performed. If bypass current is saturated, a voltage stabilizer 4 will output a saturated signal. This saturated signal is outputted to a battery charger 6 through OR circuit 5. At step 107, a control section 67 inputs the saturated signal from OR circuit 5. And the count of an input of a saturated signal is counted at step 108. In the first cycle, it becomes the number of counts 1. Corresponding to return and its number of counts 1, a contact S2 is opened by step 101 after this, and the charging current which was 25A like closing and c line of drawing 5 decreases a contact S3 to 15A. The terminal voltage falls below in a programmed voltage with reduction in the charging current like c' line of drawing 6 . A voltage stabilizer 4 is recovered controllable.

Subsequent control is performed like the above.
[0021] If a cycle is repeated and the number of counts is set to 2, the charging current is set to 5A, from step 102, it will progress to step 109 and a timer will begin to clock. The control from step 110 to step 112 is the same as that of the above-mentioned step 103 to the step 105. and -- the last step 113 -- a control section 67 -- the time check of a timer -- it judges that the setup time has passed since the number, a contact S1 is opened, and charge is ended.
[0022] Since this example tells a battery charger 6 about the thing [having been saturated] and it was made to make the charging current extract when it was constituted as mentioned above and the voltage stabilizer 4 for equalized charge was saturated, it can make current capacity of a voltage stabilizer 4 small. And by having added the voltage stabilizer 4, since quantity of electricity shown in the hatching portion of drawing 5 was bypassed, the balance of sum total part 0.27Ah can be maintained at least. Thereby, while being able to charge each cell 1 equally in a short time, current capacity of a voltage stabilizer 4 can be made small.
[0023] Drawing 7 shows the 2nd example of this invention. A logical circuit 9 is used for this example instead of OR circuit 5 of the 1st example shown in drawing 1 . Other configurations are the same as the 1st example. Two or more cells are equally divided into two blocks, one block consists of cells 1a, --, 1g, an each voltage stabilizers [4a, --, 4g] output is connected to 0R circuit 5a, the block of another side consists of cells 1h, --, 1n, and the each voltage stabilizers [4h, --, 4n] output is connected to OR circuit 5b. In addition, the total of a cell is set to 144 and two blocks are constituted from this example by the cell of 72 piece ** **. While the output of OR circuits 5a and 5b is connected to AND circuit 7, the output of an AND circuit is connected to a battery charger 6. when at least one or more voltage stabilizers output a saturated signal within both blocks, at the time of charge, an AND circuit outputs a saturated signal, and the charging current is decreased at it -- it acts.
[0024] Even if it has the same effect as the 1st example since the charging current was made to decrease when it was constituted as mentioned above and two or more voltage stabilizers outputted a saturated signal, and also the charge balance of one cell collapses, this example can prevent narrowing down the charging current of the whole group cell by the rise of the terminal voltage, and can prevent stretch of the charging time.
[0025]
[Effect of the Invention] As above, when a constant-voltage means makes the charging current bypass based on the terminal voltage of a cell, this invention By controlling charge of each cell to an equation, outputting a saturated signal, when a current saturation detection means supervises actuation of a constant-voltage means and is saturated, and a control means's controlling a charge means according to a saturated signal, and decreasing the charging current Since the saturation of a constant-voltage means was canceled, a constant-voltage means can consist of elements of small capacity. And the effect that it can charge in a short time is acquired. And a logical circuit can charge each cell equally, when at least one voltage stabilizer is saturated to the output of each current saturation detection means and it is made to output a saturated signal to a control means. Thereby, the surcharge of each cell can be prevented and the cycle life of a group cell is prolonged. Moreover, when it carries out as [decrease / when each cell is divided into the unit block of a predetermined number and at least one voltage stabilizer is saturated in each unit block / a logical circuit outputs a saturated signal to a control means, and / the charging current], it can prevent that the charging current of the whole group cell by the rise of the terminal voltage of one cell with which balance collapsed is extracted, and the effect of preventing stretch of the charging time is acquired.

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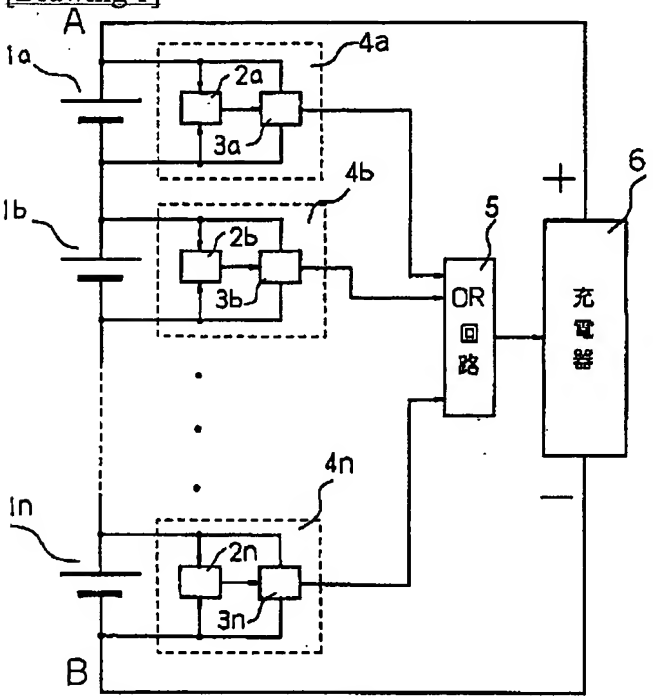
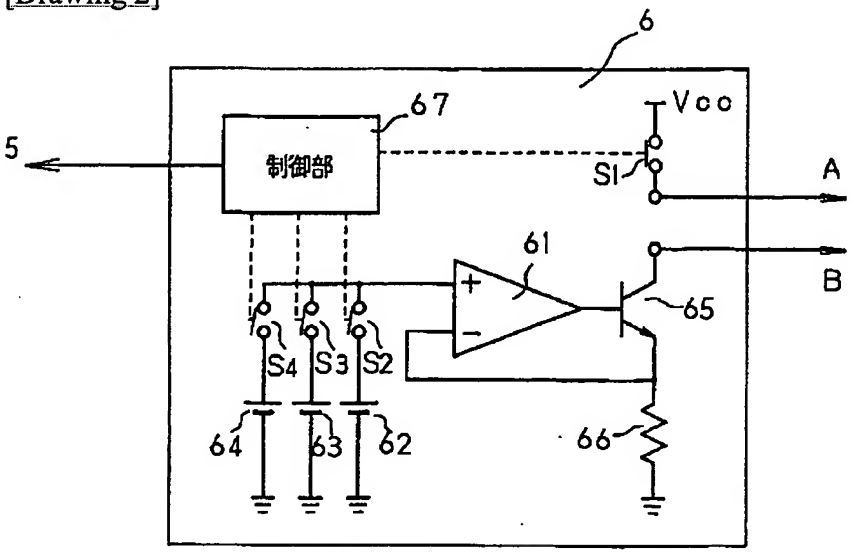
DRAWINGS

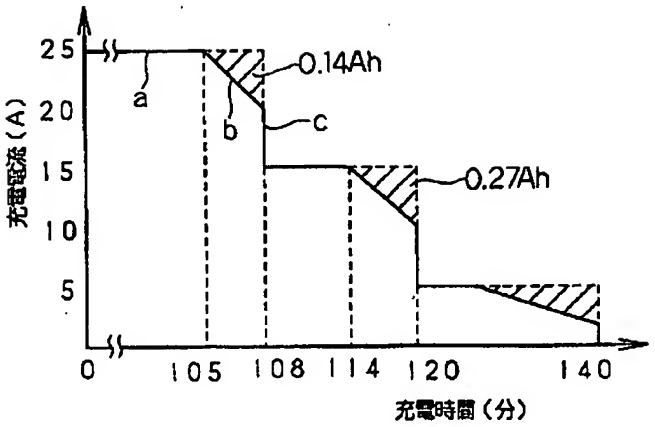
[Drawing 1]



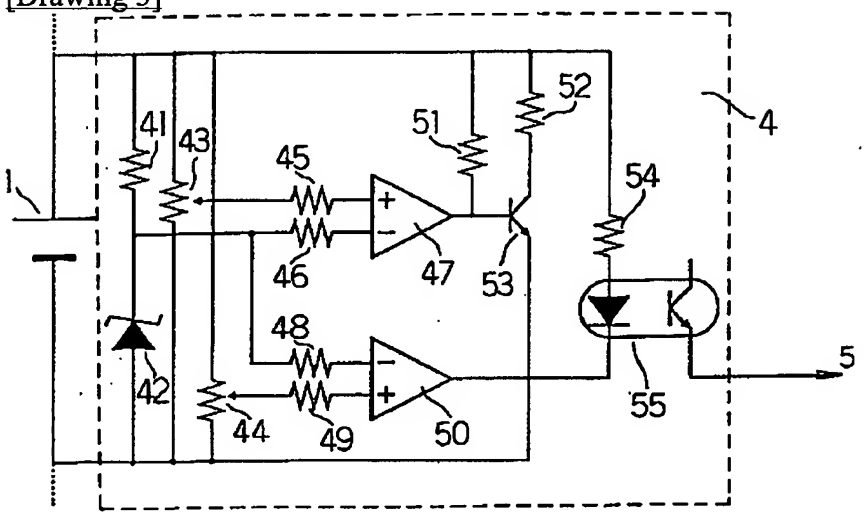
[Drawing 2]



[Drawing 5]



[Drawing 3]



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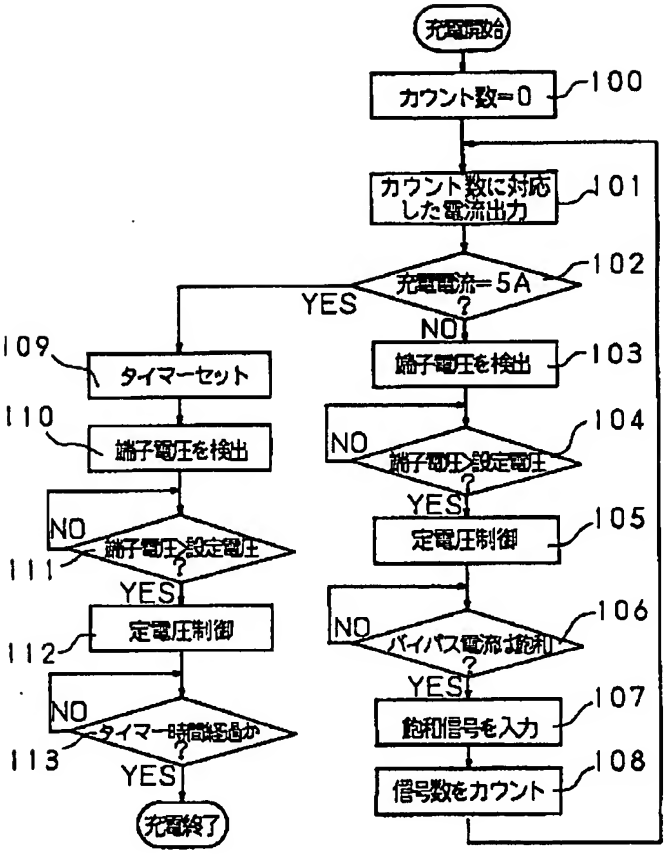
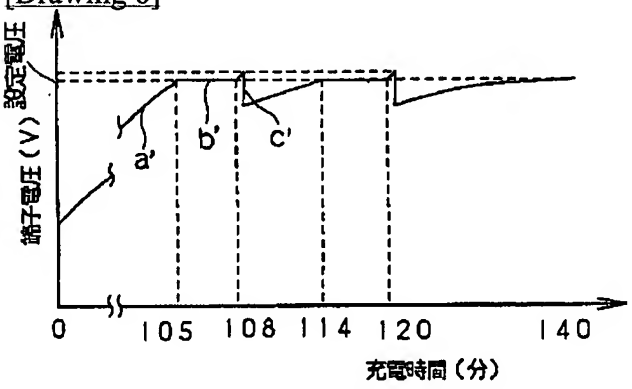
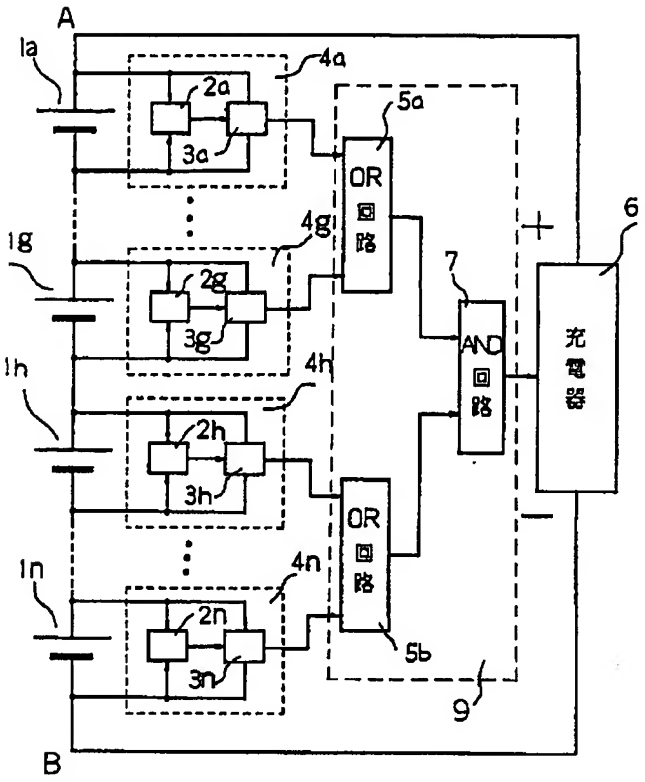


[Drawing 6]



[Drawing 7]



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